

this invention to bring about continuous boiling by a gradual (slow) depressurization. In this fashion, a uniform boiling down to molecular dimensions is enforced without a need for mixing.--.

Page 3, replace the paragraph beginning on line 7 as follows:

--According to the invention, a process for the manufacture of furfural includes the steps of charging a reactor with a pentosan containing material, acidified or not, heating the charge by introduction of pressurized steam to a first predetermined temperature, closing the steam inlet valve of the reactor and subjecting the charge to a gradual reduction of pressure until a second predetermined temperature is attained, the depressurization maintaining the liquid phase within the reactor in a constantly boiling state.--;

Page 3, replace the paragraph beginning on line 13 as follows:

--In the preferred form the rate of depressurization is sufficient to complete the conversion to furfural before a second predetermined temperature is attained. Also in the preferred form of the invention, the charge is acidified prior to heating.

Page 3, replace the paragraph beginning on line 16 as follows:

--Also in the preferred form of the invention, the gradual depressurization comprises the controlled leaking of a

stream of vapour from the reactor until the second predetermined temperature is attained.--;

Page 3, replace the paragraph beginning on line 19 as follows:

--In one form of the invention, a first depressurization is followed by a reheating to a temperature at or near the first predetermined temperature, the reheating being followed by a second gradual depressurization.--;

Page 3, replace the paragraph beginning on line 22 as follows:

--Subsequent reheating and depressurization cycles may also be employed if required.--;

Page 3, replace the paragraph beginning on line 23 as follows:

--In one form, steam may be added during depressurization to increase the reaction temperature and improve yield.--.

Page 4, replace the paragraph beginning on line 5 as follows:

--Also in the preferred form of the invention the gradual depressurization takes place in the temperature range between 280° Celsius and 150° Celsius, however the preferred range of operation is between 230° Celsius and 170° Celsius.--;

Page 4, replace the paragraph beginning on line 8 as follows:

--By an appropriate choice of the first and second temperatures, and by appropriate selection of a mineral or organic acid concentration, it is possible, if desired, to complete the process in a single depressurization period since high temperatures and high acidity result in a short reaction time.--;

Page 4, replace the paragraph beginning on line 16 as follows:

--The outlet includes, after a valve, an orifice plate of predetermined dimensions for assisting in controlling the rate of depressurization. In this form, the valve and orifice plate may be operated in tandem to obtain a range of depressurization rates or a flow control valve governed by temperature or pressure can be used.--;

Page 4, replace the paragraph beginning on line 21 and bridging pages 4 and 5 as follows:

--In an alternative form of the invention the reactor walls are designed to be heated. Also in this form, all valve operations are preferably controlled automatically by a computerized control unit. It has been demonstrated experimentally, on a pilot plant scale, that by maintaining the liquid phase of the reaction medium in a state of boiling throughout the reaction period, the furfural yield obtained is

substantially greater than current commercial processes, and if correctly controlled may approach yields achieved in the analytical furfural process. The Applicant contends further that apart from increasing the yield, the process of the invention is operable at substantially lowered capital and production costs, for the following reasons:

(1), The process of the invention does not use steam for stripping furfural from the mass of feed material as once the reactor is sufficiently heated, the steam inlet is closed. Further steam will only be required briefly if a reheating cycle is employed.

(2), As a result of the non-use of steam to strip the furfural, the volume of condensate existing the reactor is significantly reduced and the concentration of furfural therein will be proportionately increased in relation to existing processes. This increased furfural concentration will greatly simplify the primary azeotropic distillation. In special cases, for instance in the application of the furfural as a nematocide, no distillation is needed at all.

(3), The product of the invention contains less acetic and formic acid (formed from the raw material) since, after reaching the second predetermined temperature of the decompression, most of these by-products are discharged with the residue. This greatly reduces the loading of the effluent generated by the plant.--.

Page 5, between lines 17 and 18, insert the following:

--BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is a phase diagram depicting the difference between analytical and industrial furfural processes; and

Figure 2 is a schematic representation of the process and apparatus of the present invention.--;

Page 5, replace the heading on line 18 as follows:

--DETAILED DESCRIPTION OF THE INVEWNTION--.

Page 5, replace the paragraph beginning on line 21 and bridging pages 5 and 6 as follows:

--A thermally well insulated reactor 1 charged with raw material acidified or not, is heated to a temperature T_1 by admitting steam through valve 2 while the valves 3 and 4 are closed. During the very short heating process, the steam condenses, thus increasing the moisture content of the charge. Then, valve 2 is closed and a leak valve 3 is opened so as to produce a steady small flow of product vapour by gradual depressurization. This causes a slow drop in temperature. When in this fashion a suitably chosen temperature T_2 is reached, the leak valve 3 is closed to terminate the first "gradual depressurization". If at the end of this period no more furfural was obtained, the digestion is completed by opening valve 4 to discharge the residue. If, however, furfural was still obtained, the reactor is reheated and submitted to another "gradual depressurization" period. This procedure can be arbitrarily